REMARKS

The specification has been amended to correct errors of a typographical and grammatical nature. Due to the number of corrections thereto, applicants submit herewith a Substitute Specification, along with a marked-up copy of the original specification for the Examiner's convenience. The substitute specification includes the changes as shown in the marked-up copy and includes no new matter. Therefore, entry of the Substitute Specification is respectfully requested.

The claims and abstract have also been amended to more clearly describe the features of the present invention.

Entry of the preliminary amendments and examination of the application is respectfully requested.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (520.40466X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

Melvin Kraus
Registration No. 22,466

DRA/MK/jla
(703) 312-6600

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IN THE CLAIMS:

1. (Amended) A liquid cooling system, comprising:

a pump of the pulsation type for supplying cooling liquid ~~in a form of pulsation~~;

a heat receiving jacket ~~being~~ supplied with said cooling liquid~~,~~ and ~~for receiving~~ disposed to receive heat generated from a heat generating body;

a heat radiation pipe for radiating heat which is supplied by the cooling liquid passing through said heat receiving jacket; and

a passage for circulating the cooling liquid passing through said heat radiation pipe into said pump~~, wherein~~ so that said cooling liquid circulates within a closed flow passage, ~~and further~~ wherein

ΔVs is equal to or greater than ΔVp, ~~assuming that~~ with the inner volume change when said pump emits ~~the~~ a pulsation therefrom ~~is the~~ being represented by ΔVp, ~~that~~ the pressure caused ~~accompanying with~~ by said volume change ~~is~~ being represented by P, and ~~that~~ the volume change due to said pressure P which occurs in the flow passage of the cooling liquid ~~ΔVp~~, other than ~~portion of~~ in said pump, being represented by ΔVs.

2. (Amended) A liquid cooling system~~,~~ as defined in ~~the~~ claim 1, further comprising an accumulator, in which the volume change of the cooling liquid ~~owned by itself~~ in the accumulator due to said pressure P is equal to or greater than ~~the~~ ΔVp.

3. (Amended) A liquid cooling system~~,~~ as defined in the claim 1, wherein said cooling liquid is pressurized at a pressure ~~being~~ that is equal to or ~~higher~~ greater than that of ~~an~~ the atmosphere.

4. (Amended) A liquid cooling system~~,~~ as defined in the claim 2, wherein said accumulator comprises a supply opening for supplying said circulating cooling liquid therethrough and a discharge opening for discharging said cooling liquid therethrough, and a chamber that maintains gas and said cooling liquid therein.

5. (Amended) A personal computer, comprising:

a semiconductor element;

a signal input portion;

a display device; and

a liquid cooling system, including:

a pump of the pulsation type for supplying cooling liquid ~~in a form of pulsation~~;

a heat receiving jacket ~~being~~ supplied with said cooling liquid~~,~~ and ~~for receiving~~ positioned to receive heat generated within said semiconductor element;

a heat radiation pipe for radiating heat which is supplied by the cooling liquid passing through said heat receiving jacket; and

a passage for circulating the cooling liquid passing through said heat radiation pipe into said pump~~, wherein~~ so that said cooling liquid circulates within a closed flow passage, ~~and further~~ wherein

ΔVs is equal to or greater than ΔVp, ~~assuming that~~ with the inner volume change when said pump emits ~~the~~ a pulsation therefrom ~~is the~~ being represented by ΔVp, ~~that~~ the pressure caused ~~accompanying with~~ by said volume change ~~is~~ being represented by P, and ~~that~~ the volume change due to said pressure P which occurs in the flow passage of the cooling liquid ~~ΔVp~~, other than ~~portion of~~ in said pump, being represented by ΔVs.

6. (Amended) A personal computer~~,~~ as defined in the claim 5, wherein said liquid cooling system further comprises an accumulator, in which the volume change of the cooling liquid ~~owned by itself~~ in the accumulator due to said pressure P is equal to or greater than ~~the~~ ΔVp.

7. (Amended) A personal computer~~,~~ as defined in the claim 5, wherein said cooling liquid is pressurized at a pressure ~~being~~ that is equal to or ~~higher~~ greater than that of ~~an~~ the atmosphere.

8. (Amended) A personal computer, comprising:

a main body including a semiconductor element and a signal input portion;

a display device having a display portion~~, being~~ connected with said main body through a movable mechanism; and

a liquid cooling system, including:

a pump of the pulsation type for supplying cooling liquid ~~in a form of pulsation~~;

a heat receiving jacket ~~being~~ disposed within said main body and supplied with said cooling liquid, ~~and for~~ said heat receiving jacket being positioned to receive heat generated within said semiconductor element;

a heat radiation pipe being disposed ~~in~~ on a back surface of said display portion of said display device~~, and~~ for radiating heat which is supplied by the cooling liquid passing through said heat receiving jacket; ~~and~~

a passage for circulating the cooling liquid passing through said heat radiation pipe into said pump~~, wherein~~ so that said cooling liquid circulates within a closed flow passage~~;~~, and ~~said display device comprises~~

an accumulator ~~comprises:~~ connected to said closed flow passage and having a supply opening for supplying said circulating cooling liquid therethrough~~; and~~, a discharge opening for discharging said cooling liquid therethrough, and a chamber that maintains gas and said cooling liquid therein, wherein~~,~~

~~an~~ the amount of the cooling liquid maintained within said accumulator ~~is changed~~ changes ~~responding~~ in response to emission of ~~the~~ a pulsation from said pump.

9. (Amended) A personal computer~~,~~ as defined in the claim 8, wherein ΔVs is equal to or greater than ΔVp, ~~assuming that~~ with the inner volume change when said pump emits ~~the~~ a pulsation therefrom ~~is the~~ being represented by ΔVp, ~~that~~ the pressure caused ~~accompanying with~~ by said volume change ~~is~~ being represented by P, and ~~that~~ the volume change due to said pressure P in the flow passage of the cooling liquid ~~ΔVp,~~ other than ~~portion of~~ said pump, being represented by ΔVs.

10. (Amended) A personal computer, comprising:

a semiconductor element;

a signal input portion;

a display device; and

a liquid cooling system, including:

an emission pump of the pulsation type for supplying cooling liquid ~~in a form of pulsation~~ by using reciprocating movement of a diaphragm having a piezo element;

a heat receiving jacket ~~being~~ supplied with said cooling liquid~~,~~ and ~~for receiving~~ positioned to receive heat generated within said semiconductor element;

a heat radiation pipe for radiating heat which is supplied by the cooling liquid passing through said heat receiving jacket;

an accumulator ~~comprising,~~ having a supply opening for supplying said circulating cooling liquid therethrough, ~~and~~ a discharge opening for discharging said cooling liquid therethrough, and a chamber for maintaining gas and said cooling liquid therein; and

a passage for circulating the cooling liquid passing through said heat radiation pipe into said pump~~, wherein~~ so that said cooling liquid circulates within a closed flow passage, ~~and said display device comprises wherein, said cooling liquid circulates within a closed flow passage, and~~, wherein

~~an~~ the amount of ~~the~~ cooling liquid maintained within said accumulator ~~is changed responding~~ changes in response to emission of ~~the~~ a pulsation from said pump.

IN THE ABSTRACT:

A liquid cooling system for cooling a high heat generating body, such as a semiconductor element or the like, of the type used in an electronic apparatus ~~being~~ that is small and thin in ~~sizes~~ size, or in a personal computer equipped with such ~~the~~ a structure therein~~, comprising~~. The system has a ~~ump~~ pump of the reciprocal movement type, a heat receiving jacket, a heat radiation pipe, and a connector pipe for connecting those parts with one another~~, wherein those are disposed~~ so as to form a closed loop ~~and are~~ filled ~~up~~ with a cooling liquid ~~therein, and~~. In the system, ΔVs is equal to or greater than ΔVp, ~~defining that~~ wherein the inner volume change when the pump emits pulsation therefrom is ~~the~~ ΔVp, ~~that~~ the pressure caused ~~accompanying with~~ by the volume change is P, and ~~that~~ the volume change due to the pressure P that occurs in flow passage of the cooling liquid ΔVp other than ~~portion of~~ within the pump, is ΔVs.